

Now the record of the "first preliminary tremor" in the north-south direction began at Washington at 3 hours, 38 minutes, 23 seconds, followed by the "second preliminary tremors" 4 minutes and 27 seconds later; the "principal portion", or large motions, began about eight and a half minutes later than the beginning of the "first preliminary tremors". During all this period of eight and a half minutes during which motions were distinctly recorded in the north-south direction, there was an almost total absence of "preliminary tremors" in the east-west direction. Nevertheless, the "principal portion" of the earthquake record at Washington began very abruptly in the east-west component at practically the same instant of time that it began in the north-south component. In addition to this, the amplitude of the east-west motion averaged about five times greater than that of the north-south component.

These results are entirely explained if we assume that the "preliminary tremors", especially the early portions, are longitudinal or compressional waves only; that is the motions of the ground take place directly in the line of propagation, which, in this case, was almost exactly north and south, and therefore affected only the pendulum that records the north-south component, but not the east-west component. Furthermore, the relatively great magnitude of the east-west vibrations appears to be explained on the assumption that in general the stronger motions of the earthquake are surface vibrations transverse to the direction of propagation; in the present case these stronger transverse vibrations were in a strictly east-west direction.

Theories have already been put forth classifying the vibrations of earthquake motions in accordance with the foregoing ideas, but the writer is not aware that a real earthquake of considerable magnitude has ever been actually recorded at stations so favorably located as Kingston and Washington to bring out a full confirmation of the theory.

At this time (January 22) we do not know whether the records of the two seismographs at Cheltenham (a little east of Washington) show such peculiarities as to allow of similar deductions.

THE GEODETIC INSTITUTE AT POTSDAM.

The activity of the Royal Geodetic Institute at Potsdam and of the International Institute which has its center there, covers many items in which meteorologists are interested, such as the size and shape of the earth, the orography of its surface, and the variations in gravity and latitude all of which are closely related to the dynamics of the atmosphere. The annual report of the institute for the year ending April, 1906, submitted by Prof. Dr. Robert Helmert, mentions the following, among other items.

(1) An appreciative notice of the admirable map of Japan made between 1800 and 1818 by T. Ino, a learned Japanese, who knew nothing of European languages and probably very little of European methods. Up to his fiftieth year he was employed as a brewer. He then devoted six years to the study of astronomy, and in his fifty-sixth year undertook this great geodetic work, which he finished after eighteen years of steady labor. A comparison with modern work shows that his geographic latitudes, determined with the crudest instruments, are accurate to within one minute of arc.

(2) The determination of the intensity of gravity at numerous stations in Europe, and especially the absolute determination at Potsdam has occupied a very large amount of attention.

(3) The international latitude service has progressed steadily since 1900, and six continuous years of work are now available for determining the irregular motions of the axis about which the earth rotates, which motions, according to some authorities, are largely the result of meteorological processes. Five

stations in the Northern Hemisphere and two in the Southern Hemisphere are now maintained by the International Geodetic Association, and several other stations have voluntarily undertaken such work at their own expense. This work involves the determination of the latitude on every clear night continuously for several years, and the accuracy of the work must be such that a change of five feet in latitude shall be detected. Therefore this latitude work will determine in absolute measures those changes on the earth's surface for which the seismograph gives only relative measures.

(4) By comparing atmospheric pressures measured by mercurial barometers with pressures determined by means of the thermometric boiling point apparatus we are able to determine the force of gravity; and this method, which at first appeared crude, has been brought to such perfection by the labors of the Geodetic Institute that it promises to give us some idea of the variations of gravity over the surface of the ocean, for which hitherto we have had no determinations whatever. The observations made over the Indian and Pacific oceans are now in the course of computation. Whatever the outcome of this particular work may be there is no doubt but that it has already led to very great improvements in methods of determining the boiling point, and has stimulated the more accurate determination of vapor pressures at different temperatures.¹

(5) The levelings of high precision, together with the determination of the average sea-level surface serving as the basis for all accurate hypsometry, are in the hands of the Geodetic Institute, whose work in this line rivals in importance that of the United States Coast and Geodetic Survey.

(6) The relative movements of the earth's crust, as shown by observations of a horizontal pendulum, have been recorded continuously since January, 1904, in an underground chamber, about eighty feet below the ground, near the buildings of the Geodetic Institute, at Potsdam.

(7) As to seismology, proper, the astatic pendulum of Wiechert and the horizontal pendulum in the special earthquake observatory at Potsdam have been kept in continuous action.

(8) In the special report of Professor Doctor Hecker on earthquake observations he states that the tremors of the earth recorded during the years 1904 and 1905 have been submitted to an investigation with reference to their possible connection with some meteorological factor, and it is found that the amplitudes of those movements of the soil that have a period of about thirty seconds of time run parallel to the strength of the wind.² Professor Doctor Hecker also adds that the records of previous earthquakes have been examined to ascertain whether any movement of the soil could be detected as the effect of an earthquake wave reaching the station not by the shortest route from the earthquake center but by the longest route around the earth. He states that in many cases this has been possible, and thus the progressive velocities of the earthquake waves have been more accurately determined.

(9) The accuracy with which time was kept by the Riefler normal clock, with nickel-steel pendulum, in an inclosure at constant pressure, is shown by the table published by Doctor Wanach, from which it appears that a change of 1° C. in

¹ The new edition of Landolt and Börnstein's Tables, Berlin, 1905, gives us, in Tables 57-60 for the first time, the vapor tensions over ice from -50° to 0° C., the tension over water from -20 to 0° C., and the tension over water from 0° to 100° C., corrected for various sources of error and reduced uniformly to the international hydrogen thermometer scale, instead of the normal mercurial thermometer scale used by Reaumur. The tensions below 0° C. are those of Marvin and Juhlin.—ED.

² Observations in Washington show that the pressure of the wind against the walls of the building alters the distribution of the pressure within the soil so as to affect the piers upon which the seismograph is placed. As the movements of the pier are magnified from ten to a hundred times, depending upon the adjustments of the seismograph, these movements due to the wind can generally be easily distinguished from those due to an earthquake, but periodic movements of soil, pier, and pendulum are inextricably confused together.

temperature affected the daily rate by only three thousandths of a second of time, and the average daily rate of the clock during the whole year varied between 0 and two-tenths of a second. Such accuracy as this greatly facilitates the determination of the force of gravity by the pendulum method, and is an essential condition in many other branches of work.

The determination of the absolute value of the force of gravity at Potsdam by means of the reversion pendulum has been published as No. 27 of the memoirs of the Royal Prussian Geodetic Institute. This extensive work is by Prof. Dr. F. Kuehnen and Prof. Dr. P. Furtwaengler, and has been in progress since 1898. On account of the fundamental importance of the determination of the force of gravity in order to ascertain the exact shape of the earth this problem is considered one of the most important problems in geodesy, and indeed it is but little less important for all branches of terrestrial and molecular physics, and even astronomy itself; all measurements of pressure, weight, volume, density of gases and vapors made on the earth's surface are subject to any irregularity that may take place in the force of gravity. In accordance with a general principle in all exact work, that measurements must be repeated with different instruments, and under different conditions, by different persons, and at different times, in order to detect the influence of every possible source of error, these observations have been conducted under various intentional modifications of method and apparatus. The fundamental variation has been in the manner of supporting the pendulum, so that the work divides itself into two parts: (a) pendulum supported by a knife-edge, resting upon a horizontal plane; (b) pendulum supported by a plane resting upon a fixed knife-edge. The swings were made at different temperatures and pressures, and with different amplitudes of oscillation; and the reductions to standard pressure and standard temperature were accurately determined. The influence of the elastic bending of the material, and especially of the induced oscillations in the support of the pendulum demanded a long investigation. The general result of this elaborate memoir is expressed in a few words. In the pendulum room of the geodetic hall at Potsdam, latitude $52^{\circ} 22.86'$ north, longitude $13^{\circ} 4.06'$ east from Greenwich, 87 meters above sea level, the length of the simple seconds pendulum is 994.239 ± 0.003 millimeters; or the acceleration of gravity is 981.274 ± 0.003 centimeters per second per second; or a heavy body falling freely in vacuo will fall 490.637 centimeters during the first second.

PERMANENCE OF CLIMATIC CONDITIONS.

[Extract from letter of Mr. ETHAN ALLEN to the Chief of Bureau. Dated Perry, Okla., January 22, 1907.]

Observation has shown me that the weather conditions do not change; taking a number of years, say twelve, and making an average the rainfall will not vary more than an inch or two in any one period over any other. It is true that in some years the precipitation is slightly more than in others; during some years the rainfall is better distributed than others; but take any period and the rainfall is about the same. After all is said the fact remains that this is a dry country, and there are natural causes why this is so and why it will remain so.

We read in the Old Testament that Abraham, Isaac, and Jacob, old cowmen of their day, living in a dry country, were fighting over water rights; and the fact is the people living in the same country in which they lived are to-day disputing over the water necessary to support their stock. It was dry then, it is dry now, after all these years of settlers; and in a thousand or two thousand years there will not be any more rainfall in the "Panhandle" than there is now. Anyone that expects anything different will be disappointed.

While there is no change in the rainfall there is a change in the people, and the people have learned better how to farm arid lands, how to plant crops better adapted to droughty conditions, how to utilize the moisture that does fall—until some confound the change in treating the soil with a change in climatic conditions.

All the dry land east of the mountains will ultimately be utilized, with the rainfall that naturally comes, but it will be by adapting conditions to the rainfall—never by changing the rainfall, for that is impossible.

IS NOT HONESTY THE WISEST POLICY?

A significant article in the Independent of January 31 narrates the trials of an honest independent thinker, who at the end of a long life is only able to say: "I am a slave to my committee, and always have been;" and again: "I like to recall the intellectual, as well as spiritual, independence of my grandfather, but that was fifty years ago. * * * Men are no longer measured by spirituality, or by intellectual achievements. * * * It is a miserable fact, which we must honestly face, that the average man is hypnotized out of his independence and manhood by the rich man of his environment. * * * The time has come when he who wishes to be successful must be financially independent of his salary."

All this may be true of the ministerial, educational, and some other professions, but it ought not to be true of the scientific man, and least of all of the meteorologist; and yet we are told that the frosts and freezes in one State, droughts and rains in another, earthquakes in still another, the tornadoes of some regions and the hurricanes of others, are matters about which "mum is the word"; that Weather Bureau men must not publish honest reports on these subjects because of the injury to local business enterprises and land booms, and that when they do make honest reports they must suffer attacks from those who wish to suppress the truth.

This ought not to be. If a few persons are injured by some unexpected natural phenomenon, be it earthquake, storm, frost, flood, drought, or stroke of lightning, the rest of the world is interested to know that fact; for it enables us all to be on the lookout for similar occurrences. Forewarned is forearmed, and it is the highest duty of the Weather Bureau to care for the best interests of the whole community. We are supported by the whole nation and owe to it our best service. An active business man may be justified in booming his own business and the financial interests of his clients, but he protects only a small part of the community; and the law does not allow even him, in helping his own friends, to work any injury to others. The weather, the mineral, agricultural and forest conditions, and the health of the community are among those matters of universal interest about which the whole truth should be known as nearly as we can get at it. Every patriotic citizen must rebel at the idea that a government for the people and by the people shall not be permitted to publish an honest report of data gathered by its own official observers for the use of all the people.

It is wrong to mutilate or suppress the record of an observation of a phenomenon of nature, but it is also wrong to make a bad use of the record. In fact, it is the misuse of meteorological data, not the observing or publishing, that constitutes a crime against the community. Observation and careful research are to be encouraged as useful. Misrepresentations are to be avoided as harmful. The "Independent Press" as the "Voice of the People" should be not only "Vox Populi" but "Vox Dei", repressing all cheats and hoaxes, defending the truth and the best interests of the whole nation as against the self-interest of a few.—C. A.